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Double Loop Poblem Solving Learning Models on The Students' Mathematical Literacy Skills

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Abstract

This research aims to: (1) find out the differences in mathematical literacy skills of students using the DLPS learning model and those using conventional learning models, (2) find out the differences in students' mathematical literacy skills in terms of verbal skills of students, (3) to find out the interaction of the DLPS learning model in terms of students' verbal skills on mathematical literacy skills of students. The research approach uses a quantitative approach with the type of quasi-experimental research and design of Factorial design 3 x 2. The population in this study is all eighth grade students of MTs Muhammadiyah Kampung Baru with the total is 48 people. The sample in this study is the eight-grade A as a control class while the eight grade B is as an experimental class. The instrument used in this study is a test of students 'mathematical literacy skills in the form of pretest and posttest and questionnaires to measure students' verbal skills. The data analysis technique used are descriptive statistical analysis and inferential statistical analysis. The result shows that: (1) there is a difference between the application of the DLPS learning model and the conventional model on the mathematical literacy skills of students, (2) there is a difference in students' mathematical literacy skill in terms of vebal skill of students, and (3) there is no interaction effect between the DLPS learning model in terms of verbal skill to mathematical literacy skills of students.

Keywords: DLPS; Mathematical Literacy Skills; Verbal Ability

INTRODUCTION

Mathematics is a science that deals with examining the forms of an abstract structure and the interrelated relationships between these things. Based on the results of the PISA test, Indonesia did not show so many changes to participation in the test which were in 2000, 2003, 2006, 2009 and 2012, this shows that the interest of Indonesian students to study mathematics is still low, making students less trained to answer each mathematics question (Jufri, 2015: 21). While the latest results of the 2015 PISA assessment show that Indonesia is ranked 67th out of 75 participating countries (Himmah & Kurniasari, 2016). And waiting for the results of PISA 2018, mathematics learning must be emphasized on understanding concepts.

Based on an interview conducted by researchers with teacher related to the problems at MTs Muhammadiyah Kampung Baru, and observation of the school students, researchers concluded that mastery of material,

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especially in the field of mathematics, is still relatively low and in terms of the application of mathematical concepts is also lacking. The school still uses traditional learning methods where learning is only teacher-centered, so that students' understanding is limited to learning to memorize only and lack of students' ability to express problems into mathematical form until finally the students' mathematical literacy ability is still low. Skills that include the five competencies namely mathematical problem solving competency, mathematical communication competency, mathematical connection competency, mathematical reasoning competency, and mathematical representation competency, are mathematical literacy skills according to NCTM. According to the draft of assessment of PISA 2012, PISA defines that mathematical literacy skills are as follows: "mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of context. It includes reasoning mathematically and using mathematical concept, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognize the role that mathematics play in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens" (OECD, 2013). Mathematical literacy has a stronger relation to attitudes towards mathematics (Colwell & Enderson, 2016; Howie & Plomp, 2002; Taskin & Tugrul, 2014) and it can give affect in understanding of mathematical concept.

Therefore, based on that definition, mathematical literacy is the ability of students to formulate and interpret mathematics in various contexts, including the ability to reason mathematically and use concepts, and procedures as tools to describe, and explain a phenomenon or event (Sumirattana, Makanong, & Thipkong, 2017). There are a number of variables that become students' mathematical determinations or literacy factors. In general, these factors can be grouped into two categories, namely factor in students (internal factors) and factors from outside the student (external factors). Internal factor can be divided into cognitive aspects, such as intellectual ability, numerical ability, and verbal ability. As well as non-cognitive aspects such as interest and motivation. The external factors include the family environment, school, and the environment of the mass media and social environment (Mahdiansyah & Rahmawati, 2014).

Verbal ability (linguistic intelligence) is a capacity where we use language to convey thoughts and understand other people's words, both verbally and in writing (Prasetyo & Andriani, 2009: 43). Based on these factors, it can be seen that verbal abilities also have an influence on students' mathematical literacy ability. The results of the study showed verbal ability had a positive effect on the ability to solve students' math problems, it can be interpreted that the better or better the higher the verbal ability possessed by students, the better the students' ability to solve math problems will be higher or higher (Wahyuddin & Ihsan, 2016).

Indonesia is always at the bottom based on the result of the PISA test, it shows that students' mathematical literacy skills are still so low. PISA questions are a collection of questions which have a standard that can assess how high a student's mathematical literacy skills are. The learning process is a vibrant and dynamic social interaction environment, in which there are full of interaction activities between students and students, between teachers and students, and with other sources. The process greatly

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determines how the learning outcomes of students are. Specifically, teacher-centered learning format will have an impact where most student learning outcomes are low. Learning outcomes will be better if students are actively involved in the learning process that takes place in the classroom. one of alternatives which is as a solution to the problem, namely by using the learning approach Double Loop Problem Solving. Double Loop Learning is an essential method involving 'out-of-the box thinking', by employing cognitive rules or reasoning to design and implement actions (Al-Raqadi, Abdul Rahim, Masrom, & Al-Riyami, 2016). Double-Loop Learning is an organizational learning concept and includes the idea that an organization continuously learns and evolves as a whole, if collective experiences (e.g., failures and successes) are used for evolving the organizational reference framework through consistent correction of its basic governing variables (Matthies & Coners, 2018). Double loop learning emphasizes the use of an additional learning stage to acquire more knowledge or find better problem-solving methods during the learning process (Blackman, Connelly, & Henderson, 2004; Hwang & Wang, 2016; Vallat, Bayart, & Bertezene, 2016). Double-loop learning aims to challenge and change management's mental model or theory that underlies action with a new theory or model (Kim, MacDonald, & Andersen, 2013; Petersen, Montambault, & Koopman, 2014). Double loop learning enables organizations to be proactive in decision making to achieve better organizational outcomes (Reddick, Chatfield, & Ojo, 2017).

The novelty of the approach proposed in this paper is the relationship of the Double Loop Learning with students' mathematical literacy skills. The previous study was investigated the effects of peer scaffolding in inquiry-based games on the tendency to engage in double-loop learning and performance in integrated science process skills (Rahmani, Abbas, & Alahyarizadeh, 2013), the other study was investigated the impact of applying a systems approach for service operations design, expressed as the Vanguard Method in order to activate ''double-loop'' learning in service organisations (Jaaron & Backhouse, 2017).

DLPS is a solution to the problem so students understand what must be achieved, and this model can support the growth of students' creative thinking activity. Double Loop Problem Solving is a development model or variation of learning model based on problem where the emphasis is on the search for the main cause of the problem (Lestari & Yudhanegara, 2015: 70). So, the Double Loop Problem Solving learning model is one of learning models, where students play an active role in finding the initial cause of a problem.

METHOD

The type of research used is quasi experiment research. Research design used is factorial design 3 x 2. The variables in this study are 3, namely, the independent variable DLPS learning model, the variable dependent on students' mathematical literacy skill, and moderator variable of students' verbal ability. This study involved two classes or groups, namely the experimental group that was treated by applying the DLPS learning model, and the control group that applied the conventional learning model. The population in this study were all the eighth grade students of MTs Muhammadiyah Kampung Baru, and sampling using saturated sample technique with the

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reason that the researchers took the entire population in this study.

The types of instruments used are tests and non-tests. The test is used to collect data on students 'mathematical literacy skills in the form of tests before treatment (pretest) and tests after treatment (posttest), and there are two types of non test in this study, namely questionnaires to determine students' verbal abilities and observations to see achievement in the learning process. In collecting data, the researchers went through several stages, namely 1) the preparation stage, 2) the implementation stage, 3) the data processing stage, 4) the stage of making conclusions, and 5) the reporting stage. The data collected in this study is derived from literature review and field review, reading books related to the problem in this study is a source of literature studies, where the results of reading are citied directly and indirectly.

The validity of the instrument is calculated using the person product moment formula and in its calculations is assisted with the IBM SPSS 20 program for Windows, manually the formula of correlation of person product moment uses a formula (Arikunto, 2006: 162). Instrument reliability test uses alpha formula and the calculation is assisted by IBM SPSS 20 program for Windows, alpha formula manually uses formula (Arikunto, 2006: 196). There are two analyzes used in this study, namely descriptive analysis and inferential analysis. Before the data is analyzed, an analysis prerequisite test is carried out, namely normality test and homogeneous test as stated by (Sudjana, 2005: 239). In accordance with the research hypothesis, the technique used in analyzing the data is a test of the difference of the two averages, analysis of variance, and analysis of two-ways variants. According to Kadir (2016: 296), the test of difference of the two averages is used to compare the data of two sample groups, according to Purwanto, variance analysis is used to see differences between groups, and to see the effects of interactions between variable used two-way analysis of variance (Arikunto, 2006: 253).

FINDINDS AND DISCUSSION

Description of students' mathematical literacy skills using the DLPS learning model and students using conventional learning model can be seen in table 1.

Table 1. Description of Students' Mathematical Literacy Skills in Experimental Class and the Control Class

Description	Experimental Class		Control Class	
	Pretest	posttest	pretest	posttest
High	1	3	3	1
Medium	21	18	21	23
Low	1	2	1	1
Maximum Value	46	79	45	62
Minimum Value	63	94	60	78
Average Value	50,70	88,13	49,52	66,72
Standard of Deviation	3,336	2,897	3,229	2,965

Average values which are found from pretest and posttest in experimental class are 50,70 and 88,13 so it can be concluded that the initial description of the level of mathematical

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literacy in experimental class is in the medium category. The average values of pretest and post test of control class are 46,52 and 66,72 it can be concluded that the initial description of the level of mathematical literacy in control class is also in the medium category. Based on the descriptive results obtained from students' mathematical literacy abilities, the researchers concluded that the results were in line with the conditions or situations that occurred during the learning process. Where in the implementation of the research there were still factors that originated from the students themselves, for example, most of them played and discussed with their group-mates. Based on the reality, these factors were very influential during this research because if the class conditions were noisy it means that researchers could not apply the learning model well and neither did he delivery of material that was not so optimal.

Description of verbal skills of students using the DLPS learning model and students using conventional learning models can be seen in table 2.

Table 2. Description of Skills of Students of Experimental class and Control Class

Description	Experimental Class	Control Class
High	3	3
Medium	18	20
Low	2	2
Maximum Value	45	45
Minimum Value	83	83
Average Value	63,65	62,16
Standard of Deviation	8,542	8,050

Based on the average value obtained for experimental class, which indicates that the level of verbal ability of students is in the medium category. Based on the average value obtained in Control Class, it is 62.16 which indicates that the level of verbal ability of students is also in the medium category. Based on the description of students' verbal abilities obtained, the researchers concluded that the results were in line with the conditions or situations during the process of students answering verbal ability questionnaires. Based on the condition of the students when answering the questionnaire, students were still noisy when answering and asking each other's choice or their friends, so that students had not been honest in answering the questionnaire provided.

Before testing the statistical hypothesis, the researcher first conducted a prerequisite test. The data to be analyzed were the results of tests of students' mathematical literacy skills in the experimental and control class, the data were in the form of pretest and posttest, and the results of the questionnaire verbal ability tests of experimental class and control class students. The prerequisite test was the normality test and homogeneouseity test. The normality test uses the Kolmogorov-Smirnov test and the variance homogeneouseity test uses the F test. The results of the normality test can be seen in table 3 and table 4.

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Table 3. Normality Test of Mathematical Literacy Skills of Students (Test)

		Pretest Control	Posttest control	Pretest Experiment	Posttest Experimental
N		25	25	23	23
Normal Parameters	Mean	49.52	66.72	50.70	88.13
	Std. Deviation	3.229	2.965	3.336	2.897
Most Extreme Differences	Absolute	.142	.213	.217	.178
	Positive	.142	.213	.217	.129
	Negative	-.098	-.140	-.091	-.178
Kolmogorov-Smirnov Z		.712	1.065	1.043	.852
Asymp. Sig. (2-tailed)		.691	.207	.227	.462

Table 4. Normality Test of Mathematical Literacy Skills of Students (Questionnaire)

		Quistionaire of Control Class	Quistionaire of Experimental Class
N		25	23
Normal Parameters	Mean	62.16	63.61
	Std. Deviation	8.050	8.441
Most Extreme Differences	Absolute	.143	.131
	Positive	.130	.131
	Negative	-.143	-.123
Kolmogorov-Smirnov Z		.713	.629
Asymp. Sig. (2-tailed)		.689	.824

Commented [Z1]: Judul tabel sudah benarkah?

Based on table 3, on pretest of experimental class it was found the significant value for Kolmogorov-Smirnov which was 0.227 > 0,05 it can be concluded that data distribute normally, in the posttest in the experimental class it was found the significant value for Kolmogorov-Smirnov which was 0,462 > 0,05 so the data distribute normally. In the pretest in the control class the significant value was 0,691 > 0,05 so the data distribute normally, posttest in the control class it was found the significant value for Kolmogorov-Smirnov which was 0,207 > 0,05 so the data distribute normally. Based on table 4, on questionnaire in experimental class it was found the significant value for Kolmogorov-Smirnov which was 0.824 > 0,05 it can be concluded that the data distribute normally. In the questionnaire of the control class it was found the significant value for Kolmogorov-Smirnov which was 0.689 > 0,05 it can be concluded that the data distribute normally.

The results of variance homogeneouseity test can be seen in table 5 and table 6.

Table 5. Test of Homogeneouseity of Mathematical Literacy Skills of Experimental and Control Class Students

	Levene Statistic	df1	df2	Sig.
PRETEST	.172	1	46	.680
POSTTEST	.000	1	46	.997

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Table 6. Homogeneouseity Test of Verbal Ability of Students Experimental Class and Control Class

Questionnaire			
Levene Statistic	df1	df2	Sig.
.146	1	46	.704

Based on table 5, it was found that levene Statistic = 0,172 df_1= 1; df_2= 46 and p-value significant = 0,680 > 0,05 or H_0 is accepted. So, the data of pretest are homogeneous. From the results of the analysis on table 4.9, it was found that levene Statistic = 0,000 df_1= 1; df_2= 46 and p-value significant = 0,997 > 0,05 or H_0 was accepted. So, the data of posttest are homogeneous. Based on table 6, it was found that levene Statistic = 0,146; df_1= 1; df_2= 46 and p-value is significant = 0,704 > 0,05 or H_0 accepted. So, the data of questionnaire of verbal skills are homogeneous.

The first hypothesis proposed in this study is that there are differences in students' mathematical literacy skills using the DLPS learning model and conventional learning model in the eight grade in MTs Muhammadiyah Kampung baru Kec. Gantarang Kab. Bulukumba. Based on the result of calculation usingi t on α = 0,05 for hypothesis 1, it can be seen in table 7.

Table 7. Hypothesis 1

		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Literacy Skills	Equal variances assumed	.000	.997	-25.268	46	.000	-21.410	.847	-23.116	-19.705
	Equal variances not assumed			-25.293	45.825	.000	-21.410	.847	-23.115	-19.706

Based on table 7, because$|t_{count}|$ = $|-25{,}268| > t_{table}$ = 2,013 and value Sig. < α = 0,000 < 0,05, it can be concluded that that there is a difference between the application of the DLPS learning model and the conventional model of students' mathematical literacy skills in the eighth grade in MTs Muhammadiyah Kampung Baru Kec.Gantarang Kab.Bulukumba.

The second hypothesis in this study is that there are differences in students' mathematical literacy skills in terms of verbal skills of students in the eight grade in MTs Muhammadiyah Kampung baru Kec. Gantarang Kab. Bulukumba. Based on the result of calculation using anava for the second hypothesis it can be seen in the table 8.

Table 8. Hypothesis 2

Group	Average	Samples
A1B1	88,00	3
A1B2	88,56	18
A1B3	84,50	2
A2B1	64,33	3
A2B2	67,00	20
A2B3	67,50	2
Total		48

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Based on table 8, it can be concluded that: (1) since 88,00 > 64,33, A1B1 > A2B1, so that is a difference in students' mathematical literacy skills in the category of high verbal skill that use the DLPS learning model and conventional learning model in the eighth grade in MTs Muhammadiyah Kampung Baru Kec. Gantarang Kab. Bulukumba, (2) since 88,56 > 67,00 , A1B2 > A2B2, so that there is a difference in students' mathematical literacy skills in the medium verbal ability category using the DLPS learning model and conventional learning model in the eighth grade in MTs Muhammadiyah Kampung Baru Kec. Gantarang Kab. Bulukumba, and (3) since 84,50 > 67,50 , A1B3 > A2B3, so that there is a difference in students' mathematical literacy skills in the category of low verbal ability using the DLPS learning model and conventional learning model in the eighth grade in MTs Muhammadiyah Kampung Baru Kec. Gantarang Kab. Bulukumba.

The third hypothesis in this study is that there is an interaction effect between the DLPS learning model in terms of students' verbal abilities towards mathematical literacy skills of students in the eighth grade in MTs Muhammadiyah Kampung Baru Kec. Gantarang Kab. Bulukumba. Based on the result of two ways calculation of anava for the hypothesis 3 which can be seen in table 9.

Table 9. Hyphotesis 3

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5540.868[a]	5	1108.174	134.475	.000
Intercept	119340.446	1	119340.446	1.448E4	.000
X	2184.605	1	2184.605	265.098	.000
Z	22.339	2	11.169	1.355	.269
x * z	27.277	2	13.639	1.655	.203
Error	346.111	42	8.241		
Total	290325.000	48			
Corrected Total	5886.979	47			

Based on table 9, since F_{count} = 1,655 ≤ F_{table} = 4,05 and value Sig. < α = 0,203 > 0,05, it can be concluded that there is no interaction effect between the DLPS learning model in terms of verbal ability to students' mathematical literacy skill in the eighth grade in MTs Muhammadiyah Kampung Baru Kec. Gantarang Kab. Bulukumba.

In testing the first hypothesis, it was concluded that there were differences in mathematical literacy skills between the experimental class and control class, the results of this study were in line with the research conducted by Lucky Heriyanti Jufri with the title "Application of Double Loop Problem Solving (DLPS) to Improve Level 3 Mathematical Literacy Skills in The Eighth Grade Students in SMPN 27 Bandung " obtained results of the class where Double Loop Problem Solving applied significantly increased in terms of mathematical literacy compared to the class that only received teaching in the conventional way, it can be seen in the average N-Gain experimental class value which was 0.43 where the average value was higher when compared to the average N-Gain value of students in the control class which was 0.34 (Jufri, 2015: 27).

In testing the second hypothesis, it was concluded that there were differences in

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students' mathematical literacy skills in terms of verbal skills of students in the eighth grade in MTs Muhammadiyah Kampung Baru, these results were in line with the research conducted by Eko Faradita Aswadi with the research title "Effects of Numeric Skill and Verbal Skill on Mathematics Learning Outcomes of The Eleventh Grade Students of MAN Kajuara ", where the results of these study are numerical skills and verbal skills together have a positive influence on student learning outcomes as indicated by the coefficient of determination which was 0.361 which means that 36.1% variations in mathematics learning outcomes can be determined by numerical skill and verbal skill together with the assumption that other variables are ignored (Aswadi, 2017: 57).

In Testing the third hypothesis, it was found that there was no interaction between the DLPS learning model in terms of students' verbal skill to mathematical literacy skill of students in the eighth grade in MTs Muhammadiyah Kampung Baru, the result of this study is in line with research conducted by Wahyuddin with the research title " Analysis of the Skills to Resolve Mathematical Story Questions in Terms of Verbal Skill "where the result of his research namely verbal skill has a positive effect on the ability to solve mathematical story problems which its effect was 42% established the remainder which was 58% affected by other variables outside the model (Wahyuddin, 2016: 148-160).

CONCLUSION

Based on the data analysis that has been stated, some conclusions can be drawn from this study, namely: (1) there is a difference between the application of the DLPS learning model and the conventional model on the mathematical literacy skills of students, (2) there is a difference in students' mathematical literacy skill in terms of verbal skill of students, and (3) there is no interaction effect between the DLPS learning model in terms of verbal skill to mathematical literacy skills of students. Based on the conclusions that have been stated, the researchers suggest that the mathematics teachers of MTs Muhammadiyah Kampung Baru use a learning model that makes students more \active and interested in participating in the learning process. Furthermore, the researchers suggest the next researchers that this research can be one of the basics and inputs in conducting relevant research, and can examine other variables that are relevant to certain materials and different conditions which will eventually produce a good and quality writing.

REFERENCE

Al-Raqadi, A. M. S., Abdul Rahim, A., Masrom, M., & Al-Riyami, B. S. N. (2016). System thinking in single- and double-loop learning on the perceptions of improving ships' repair performance. *International Journal of Systems Assurance Engineering and Management*, *7*, 126–142. https://doi.org/10.1007/s13198-015-0353-7

Arikunto, S. (2006). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: PT Rineka Cipta.

Aswadi, E. F. (2017). *Pengaruh Kemampuan Numerik dan Kemampuan Verbal terhadap Hasil Belajar Siswa Kelas XI MAN 1 Kajuara*. UIN Alauddin Makassar.

ISSN 2301-7929 (print), ISSN 2502-1745 (online)

Blackman, D., Connelly, J., & Henderson, S. (2004). Does double loop learning create reliable knowledge? *The Learning Organization*, *11*(1), 11–27. https://doi.org/10.1108/09696470410515706

Colwell, J., & Enderson, M. C. (2016). When I hear literacy: Using pre-service teachers' perceptions of mathematical literacy to inform program changes in teacher education. *Teaching and Teacher Education*, *53*, 63–74. https://doi.org/10.1016/j.tate.2015.11.001

Himmah, N. rif'atul, & Kurniasari, I. (2016). Profil Pemecahan Masalah Matematika Model Pisa Berdasarkan Kemampuan Matematika Siswa Sma. *MATHEdunesa Jurnal Ilmiah Pendidikan Matematika Volume 3 No. 5 Tahun 2016 ISSN : 23019085*, *3*(5).

Howie, S., & Plomp, T. (2002). Mathematical literacy of school leaving pupils in South Africa. *International Journal of Educational Development*, *22*(6), 603–615. https://doi.org/10.1016/S0738-0593(01)00030-X

Hwang, G. J., & Wang, S. Y. (2016). Single loop or double loop learning: English vocabulary learning performance and behavior of students in situated computer games with different guiding strategies. *Computers and Education*, *102*, 188–201. https://doi.org/10.1016/j.compedu.2016.07.005

Jaaron, A. A. M., & Backhouse, C. J. (2017). Operationalising "Double-Loop" Learning in Service Organisations: A Systems Approach for Creating Knowledge. *Systemic Practice and Action Research*, *30*(4), 317–337. https://doi.org/10.1007/s11213-016-9397-0

Jufri, L. H. (2015). Penerapan Double Loop Problem Solving untuk Meningkatkan Kemampuan Literasi Matematis Level 3 Siswa di Kelas VIII SMPN 27 Bandung. *Lemma*, *2*(1), 52–62.

Kadir. (2016). *Statistika Terapan: Konsep, Contoh, dan Analisis Data dengan SPSS/Lisrel dalam Penelitian*. Jakarta: PT Grafindo Persada.

Kim, H., MacDonald, R. H., & Andersen, D. F. (2013). Simulation and Managerial Decision Making:A Double-Loop Learning Framework. *Public Administration Review*, *73*(2), 291–300. https://doi.org/10.1111/j.1540-6210.2012.02656.x

Lestari, E. K., & Yudhanegara, M. R. (2015). *Penelitian Pendidikan Matematika*. Bandung: PT. Refika Aditama.

Mahdiansyah, M., & Rahmawati, R. (2014). Literasi Matematika Siswa Pendidikan Menengah: Analisis Menggunakan Desain Tes Internasional dengan Teks Indonesia. *Jurnal Pendidikan Dan Kebudayaan*, *20*(4), 452–469.

Matthies, B., & Coners, A. (2018). Double-loop learning in project environments: An implementation approach. *Expert Systems with Applications*, *96*, 330–346. https://doi.org/10.1016/j.eswa.2017.12.012

OECD. (2013). *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Einancial Literacy*. Paris: OECD Publisher.

Petersen, B., Montambault, J., & Koopman, M. (2014). The Potential for Double-Loop Learning to Enable Landscape Conservation Efforts. *Environmental Management*, *54*(4), 782–794. https://doi.org/10.1007/s00267-014-0337-4

Prasetyo, R., & Andriani, Y. (2009). *Multiply Your Multiple Intelligences*. Yogyakarta: Andi.

ISSN 2301-7929 (print), ISSN 2502-1745 (online)

Rahmani, R., Abbas, M., & Alahyarizadeh, G. (2013). The Effects of Peer Scaffolding in Problem-based Gaming on the Frequency of Double-loop Learning and Performance in Integrated Science Process Skills. *Procedia - Social and Behavioral Sciences*, *93*, 1994–1999. https://doi.org/10.1016/j.sbspro.2013.10.154

Reddick, C. G., Chatfield, A. T., & Ojo, A. (2017). A social media text analytics framework for double-loop learning for citizen-centric public services: A case study of a local government Facebook use. *Government Information Quarterly*, *34*(1), 110–125. https://doi.org/10.1016/j.giq.2016.11.001

Sudjana, N. (2005). *Dasar-Dasar Proses Belajar Mengajar Matematika*. Bandung: Sinar Baru Algesindo.

Sumirattana, S., Makanong, A., & Thipkong, S. (2017). Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. *Kasetsart Journal of Social Sciences*, *38*(3), 307–315. https://doi.org/10.1016/j.kjss.2016.06.001

Taskin, N., & Tugrul, B. (2014). Investigating Preschool Teacher Candidates' Mathematics Literacy Self-sufficiency Beliefs on Various Variables. *Procedia - Social and Behavioral Sciences*, *116*, 3067–3071. https://doi.org/10.1016/j.sbspro.2014.01.708

Vallat, D., Bayart, C., & Bertezene, S. (2016). Serious games in favour of knowledge management and double-loop learning? *Knowledge Management Research and Practice*, *14*(4), 470–477. https://doi.org/10.1057/kmrp.2015.29

Wahyuddin. (2016). Analisis Kemampuan Menyelesaikan Soal Cerita Matematika Ditinjau dari Kemampuan Verbal. *Beta: Jurnal Tadris Matematika*, *9*(2), 148–160.

Wahyuddin, W., & Ihsan, M. (2016). Analisis Kemampuan Menyelesaikan Soal Cerita Matematika Ditinjau Dari Kemampuan Verbal Pada Siswa Kelas Vii Smp Muhammadiyah Se-Kota Makassar. *Suska Journal of Mathematics Education*, *2*(2), 111. https://doi.org/10.24014/sjme.v2i2.2213

ISSN 2301-7929 (print), ISSN 2502-1745 (online)